NASA Facts

National Aeronautics and
Space Administration

Marshall Space Flight Center
Huntsville, Alabama 35812

Active Rack Isolation System (ARIS)

Missions: Expedition 2, ISS Mission 6A, STS-101 Space Shuttle Flight
Experiment Location on ISS: Express Rack No. 2
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Overview

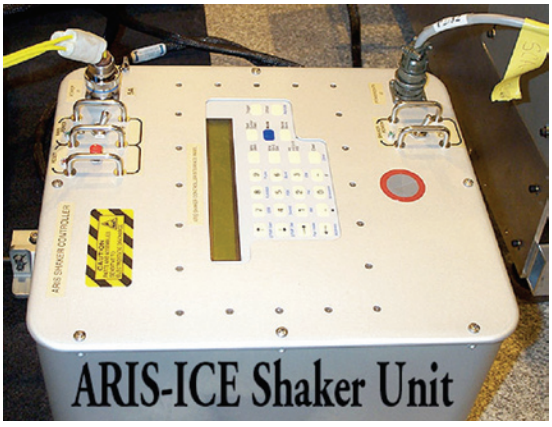
Even in the quiescent, virtually gravity-free, environment of the International Space Station, tiny potential vibrations or disturbances—such as those caused by crew exercise—can upset sensitive science experiments. The Active Rack Isolation System (ARIS) acts as a vibration absorber to help isolate them. By acting as a buffer between the experiment and these vibrations, ARIS will protect delicate experiments housed in EXPRESS Rack No. 2 from outside influences that could potentially affect research results. The EXPRESS Rack, which stands for EXpedite the PRocessing of Experiments to the Space Station, is a standardized payload rack system that transports, stores and supports experiments aboard the International Space Station. NASA fuels discoveries that make the world smarter, healthier and safer.

Experiment Operations

The ARIS system was installed in EXPRESS Rack No. 2—a standardized payload rack that transports and houses experiments aboard the International Space Station. ARIS attenuates—or reduces—external vibration disturbances at selected payload locations.

ARIS achieves this disturbance reduction using a combination of sensors and actuators. When sensors detect disturbances from the Space Station, the actuators work to counter the effects of vibrations by delivering a reactive force between the payload rack and the laboratory module. In this way, it performs like a powered shock absorber, acting as buffer between the experiments and any outside disturbances.

Much more complex than traditional shock absorbers, ARIS is a finely tuned system with multiple components. Among these are accelerometer assemblies that measure vibration disturbances and send data to the ARIS electronic unit; pushrods that apply force against the framework of the Space



Pre-flight image of the "shaker" device used to induce known disturbances into EXPRESS Rack 2 to test the Active Rack Isolation System.

Station; and a microgravity rack barrier that prevents accidental disturbance of the active ARIS rack.

The ARIS system was installed in the International Space Station during the STS-100 Space Shuttle Mission, part of Expedition 2, ISS Mission 6A, in April 2001.

ARIS will be primarily controlled from the ground by the Payload Rack Officer (PRO) on-duty at the Payload Operations Center, located at NASA's Marshall Space Flight Center in Huntsville, Ala. Seven days a week, 24 hours a day, a rack officer will be on-hand to operate ARIS as an EXPRESS Rack subsystem to support payloads in the rack.

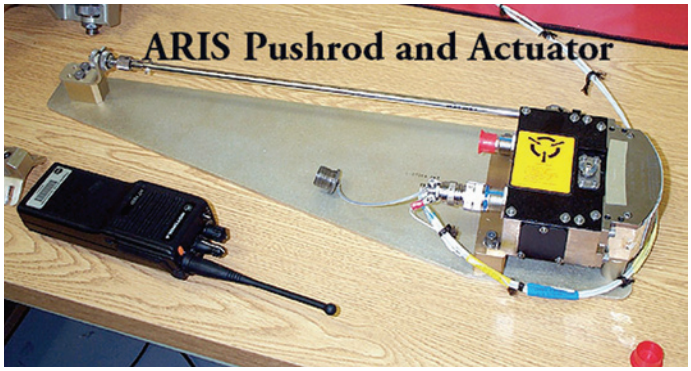
After installation, the ARIS system at any time can be commanded to Active Isolation mode—the mode in which it actively reduces external disturbances—with minimal crew time. Using laptop computer displays, the crew will be able to activate or deactivate ARIS hardware, perform pushrod alignment procedures or change ARIS states of operation.

States of ARIS operations include:

- Idle: ARIS does not attempt to control position or acceleration of the rack.
- Hold: ARIS centers the rack and holds its position relative to the Space Station without actively reducing vibrations.
- Active: ARIS senses and compensates for acceleration to maintain microgravity environment.
- NOGO: ARIS is in an idle-like state and does not attempt to control position or acceleration. ARIS enters this state upon any error, or failure of the active built-in test that is part of the initialization sequence.

Flight History/Background

A prototype of the ARIS system was tested during the Space Shuttle STS-79 mission, a 1996 flight during which Space Shuttle Atlantis docked with the Russian space station Mir. To simulate



Pre-flight image of the ARIS pushrod and actuator with a two-way radio for size comparison.

the weight of future scientific payloads, five lockers within the ARIS rack on STS-79 were filled with 375 pounds of Russian food packages delivered to the Mir crew during the mission. After the ARIS system was activated, the astronauts conducted an extensive series of tests that indicate ARIS was successful in reducing the impact of off-board disturbances.

Benefits

The NASA Microgravity Research Program strives to increase the understanding of the effects of gravity on biological, chemical and physical systems. The International Space Station will permit long-duration microgravity experiments in an environment otherwise more similar to Earth-based laboratories—minus the gravity.

The ARIS system will enhance the ability of scientists to conduct these experiments. By countering vibrational disturbances that could potentially damage the research results of certain delicate experiments, ARIS will play a key role in the success of this permanent laboratory in space.

More information on the ARIS system and the International Space Station can be found at:
http://www.nasa.gov

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